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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/628,451	07/29/2003	Michio Morita	60188-581	4849

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EXAMINER	
SCHILLINGER, LAURA M	

ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 01/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/628,451	MORITA, MICHIO	
	Examiner	Art Unit	
	Laura M. Schillinger	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 December 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10* is/are pending in the application.

4a) Of the above claim(s) *9 and 10* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *7/29/03*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Claims 9-10 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected claims, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 12/22/04.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

Claims 1-2, 6 are rejected under 35 U.S.C. 102(a) as being anticipated by Applicant's Admitted Prior Art (hereinafter referred to as "APA").

APA teaches the following claimed limitations as cited below, referencing the Applicant's specification:

1. A method for forming a multilayer interconnect, comprising:

a first step of forming a lower layer interconnect in an upper portion of a first insulating film(APA, page 1, lines: 20-25) and then forming a second insulating film and a third insulating film in this order on the first insulating film including the lower layer interconnect (APA- page 2, lines: 1-5);

a second step of forming an aperture in part of the third insulating film located above the lower layer interconnect (APA, page 2, lines: 5-11);

a third step of forming an interconnect groove in an upper portion of the third insulating film so that an upper portion of the aperture is part of the interconnect groove, while reducing the thickness of part of the second insulating film located under the aperture without having the lower layer interconnect exposed (APA, page 2, lines: 15-25);

a fourth step of removing part of the second insulating film located under the aperture to expose the lower layer interconnect (APA, page 3, lines: 5-15); and

a fifth step of tilling a conductive film in the aperture and the interconnect groove and thereby forming an upper layer interconnect and a connection portion for electrically connecting the upper layer interconnect and the lower layer interconnect (APA, page 3, lines: 10-20).

2. The method of claim 1, wherein the second step includes reducing the thickness of part of the second insulating film located under the aperture (APA, page 3, liens: 5-15).

6. The method of claim 1, further comprising the step of forming a reflection- prevention film over the second insulating film(APA, page 2 , lines: 5-10), wherein the second step includes removing part of the reflection-prevention film in which the aperture is to be formed (APA, page 2, lines: 5-12), and wherein the third step includes removing part of the reflection-prevention film in which the interconnect groove is to be formed (APA, page 2, lines: 15-20).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 3- 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over APA as applied to claim 1 above, and further in view of Imai et al ('092).

In reference to claim 3, APA teaches wherein the second and third insulating films are formed of silicon nitride and silicon oxide, respectively, wherein in the second step, the aperture is formed by dry etching (APA, page 2, lines: 1-11) and wherein in the third step, the interconnect groove is formed by dry etching (APA, page 2, lines: 15-20).

However, APA fails to explicitly teach Applicant's additional claimed limitation of using a first etching gas containing a fluorocarbon gas and an oxygen gas, and wherein in the third step, the interconnect groove is formed using a second etching gas containing a fluorocarbon gas and an oxygen gas.

In reference to claim 4, APA fails to explicitly teach wherein in the second step, the ratio of the fluorocarbon gas to the oxygen gas in the first fluorocarbon gas are adjusted to control the depth of part of the second insulating film located under the aperture.

Lastly, in reference to claim 5 APA fails to explicitly teach wherein in the third step, the ratio of the fluorocarbon gas to the oxygen gas in the second etching gas and the ratio of carbon to fluoride in the fluorocarbon gas are adjusted to control the depth of part of the second insulating film located under the aperture.

In reference to claim 3, Imai et al ('092) teaches to etch dielectric layers using a dry etch process including fluorocarbon and oxygen gas (Abs., lines: 1-10). In reference to claim 4, Imai also teaches that the ratio of fluorocarbon gas to oxygen may be adjusted to give added etch control (Col.6, lines: 5-26). Lastly, in reference to claim 5, Imai teaches that the ratio of carbon to fluoride in the fluorocarbon gas may be adjusted to control etch depth (Col.6, lines: 5-15 and Abs., lines: 1-10).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Applicant's Admitted prior art to include a dry etch process implementing fluorocarbon and oxygen as taught by Imai because as Imai teaches, such gases may result in improved etch selectivity ratios and rates (Abs., lines: 1-10).

In reference to claim 7, APA teaches wherein the reflection-prevention film is formed of silicon oxide nitride so as to have a smaller thickness than that of the second insulating film, and

wherein in the third step, the reflection-prevention film is removed by etching (Page 2, lines: 5-11).

However, APA fails to teach that the etching occurs under the condition where the temperature of a lower electrode of an etching apparatus is 30 C or more.

Imai teaches a similar method wherein the etching is conducted at a temperature of 30 C or more (Col.s 6-7, lines: 60-42).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Applicant's APA to further include an etch temperature of 30 degrees or higher as taught by Imai because as Imai teaches, such higher temperatures result in stable contact hole etching (Col.7, lines: 1-10).

In reference to claim 8, APA fails to teach wherein in the fourth step, the lower layer interconnect is exposed by etching under the condition where bias power for an etching apparatus is 500 W or less.

Imai teaches a bias power of 1000 to 3000 W (Col.3, lines: 60-65). However, this claim is prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See

also In re Huang, 40 USPQ2d 1685, 1688(Fed. Cir. 1996)(claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA 1985) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Laura M. Schillinger whose telephone number is (571) 272-1697. The examiner can normally be reached on M-T, R-F 7:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W. Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

LMS

1/20/05